Indiana Academic Standards 2014 Lesson Plan Alignment Template

Subject(s): ____________________ **Period(s):** _________ **Grade(s):** _____________

Teacher(s): ____________________________________ **School:** __________________

The lesson plan alignment tool provides examples of the instructional elements that should be included in daily planning and practice for the Indiana Academic Standards. The template is designed as a developmental tool for teachers and those who support teachers. It can also be used to observe a lesson and provide feedback or to guide lesson planning and reflection.

LESSON ELEMENT PROVIDE STUDENT-FRIENDLY TRANSLATION WHERE APPLICABLE
1. **Grade level Indiana Academic Standard(s) 2014 the lesson targets include:**
2. **Learning Target(s):**
3. **Relating the Learning to Students:**
4. **Assessment Criteria for Success:**
5. **- Content Area Literacy standards for History /Social Studies, Science, & Technical Subjects:** **- Math Process Standard(s):**

6. **Academic Vocabulary:**
7. **Examples/Activities/Tasks:**
8. **Resources/Materials:**
9. **Access and Engagement for All:**
10. **Differentiation/Accommodations:**

Indiana Academic Standards Aligned Lesson: Reflection

➢ In addition, please choose ONE question below to respond to after you have taught the lesson OR create your own question and respond to it after you have taught the lesson.

1. How did this lesson support 21st Century Skills?
2. How did this lesson reflect academic rigor?
3. How did this lesson cognitively engage students?
4. How did this lesson engage students in collaborative learning and enhance their collaborative learning skills?

http://www.doe.in.gov/sites/default/files/standards/indiana-academic-standards-2014-aligned-lesson-plan-template-blank.docx

Posing Purposeful Questions

Effective teaching of mathematics uses purposeful questions to assess and advance students' reasoning and sense making about important mathematical ideas and relationships.

Effective mathematics teaching relies on questions that encourage students to explain and reflect on their thinking as an essential component of meaningful mathematical discourse. Purposeful questions allow teachers to discern what students know and adapt lessons to meet varied levels of understanding, help students make important mathematical connections, and support students in posing their own questions. However, merely asking questions is not enough to ensure that students make sense of mathematics and advance their reasoning. Two critical issues must be considered—the types of questions that teachers ask and the pattern of questioning that they use.

Teacher and student actions

In effective teaching, teachers use a variety of question types to assess and gather evidence of student thinking, including questions that gather information, probe understanding, make the mathematics visible, and ask students to reflect on and justify their reasoning. Teachers then use patterns of questioning that focus on and extend students' current ideas to advance student understanding and sense making about important mathematical ideas and relationships. The teacher and student actions listed in the table below provide a summary of using questions purposefully in the mathematics classroom.

Pose purposeful questions Teacher and student actions	
What are *teachers* doing?	What are *teachers* doing?
Advancing student understanding by asking questions that build on, but do not takeover or funnel, student thinking.	Expecting to be asked to explain, clarify, and elaborate on their thinking.
Making certain to ask questions that go beyond gathering information to probing thinking and requiring explanation and justification.	Thinking carefully about how to present their responses to questions clearly, without rushing to respond quickly.
Asking intentional questions that make the mathematics more visible and accessible for student examination and discussion.	Reflecting on and justifying their reasoning, not simply providing answers
Allowing sufficient wait time so that more students can formulate and offer responses.	Listening to, commenting on, and questioning the contributions of their classmates.

Effective Teaching and Learning. (2014). In *Principles to Actions : Ensuring mathematical success for all* (p. 41). Reston, VA: NCTM.

Researchers have created a variety of frameworks to categorize the types of questions that teachers ask (e.g., Boaler and Brodie 2004; Chapin and O'Connor 2007). Though the categories differ across frameworks, commonalities exist among the types of questions. For example, the frameworks generally include questions that ask students to recall information, as well as questions that ask students to explain their reasoning. Figure 14 displays a set of question types that synthesizes key aspects of these frameworks that are particularly important for mathematics teaching. Although the question types differ with respect to the level of thinking required in a response, all of the question types are necessary in the interactions among teachers and students. For example, questions that gather information are needed to establish what students know, while questions that encourage reflection and justification are essential to reveal student reasoning.

	Question type	Description	Examples
1.	Gathering information	Students recall facts, definitions, or procedures.	When you write an equation, what does the equal sign tell you? What is the formula for finding the area of a rectangle? What does the interquartile range indicate for a set of data?
2.	Probing thinking	Students explain, elaborate, or clarify their thinking, including articulating the steps in solution methods or the completion of a task.	As you drew that number line, what decisions did you make so that you could represent 7 fourths on it? Can you show and explain more about how you used a table to find the answer to the Smartphone Plans task? It is still not clear how you figured out that 20 was the scale factor, so can you explain it another way?
3.	Making the mathematics visible	Students discuss mathematical structures and make connections among mathematical ideas and relationships.	What does your equation have to do with the band concert situation? How does that array relate to multiplication and division? In what ways might the normal distribution apply to this situation?
4.	Encouraging reflection and justification	Students reveal deeper understanding of their reasoning and actions, including making an argument for the validity of their work.	How might you prove that 51 is the solution? How do you know that the sum of two odd numbers will always be even? Why does plan A in the Smartphone Plans task start out cheaper but become more expensive in the long run?

Effective Teaching and Learning. (2014). In *Principles to Actions : Ensuring mathematical success for all* (pgs. 37 - 38). Reston, VA: NCTM.

Mathematical tasks can range from a set of routine exercises to a complex and challenging problem that focuses students' attention on a particular mathematical idea. Stein and colleagues (Stein, Grover, and Henningsen 1996; Stein and Smith 1998) have developed a taxonomy of mathematical tasks based on the kind and level of thinking required to solve them. Smith and Stein (1998) show the characteristics of higher- and lower-level tasks and provide samples in each category; figure 3 reproduces their list of the characteristics of tasks at four levels of cognitive demand, and figure 4 provides examples of tasks at each of the levels.

Levels of Demands

Lower-level demands (memorization):

- Involve either reproducing previously learned facts, rules, formulas, or definitions or committing facts, rules, formulas or definitions to memory
- Cannot be solved using procedures because a procedure does not exist or because the time frame in which the task is being completed is too short to use a procedure
- Are not ambiguous. Such tasks involve the exact reproduction of previously seen material, and what is to be reproduced is clearly and directly stated.
- Have no connection to the concepts or meaning that underlie the facts, rules, formulas, or definitions being learned or reproduced

Lower-level demands (procedures without connections):

- Are algorithmic. Use of the procedure either is specifically called for or is evident from prior instruction, experience, or placement of the task.
- Require limited cognitive demand for successful completion. Little ambiguity exists about what needs to be done and how to do it.
- Have no connection to the concepts or meaning that underlie the procedure being used
- Are focused on producing correct answers instead of on developing mathematical understanding
- Require no explanations or explanations that focus solely on describing the procedure that was used

Higher-level demands (procedures with connections):

- Focus students' attention on the use of procedures for the purpose of developing deeper levels of understanding of mathematical concepts and ideas
- Suggest explicitly or implicitly pathways to follow that are broad general procedures that have close connections to underlying conceptual ideas as opposed to narrow algorithms that are opaque with respect to underlying concepts
- Usually are represented in multiple ways, such as visual diagrams, manipulatives, symbols, and problem situations. Making connections among multiple representations helps develop meaning.
- Require some degree of cognitive effort. Although general procedures may be followed, they cannot be followed mindlessly. Students need to engage with conceptual ideas that underlie the procedures to complete the task successfully and that develop understanding.

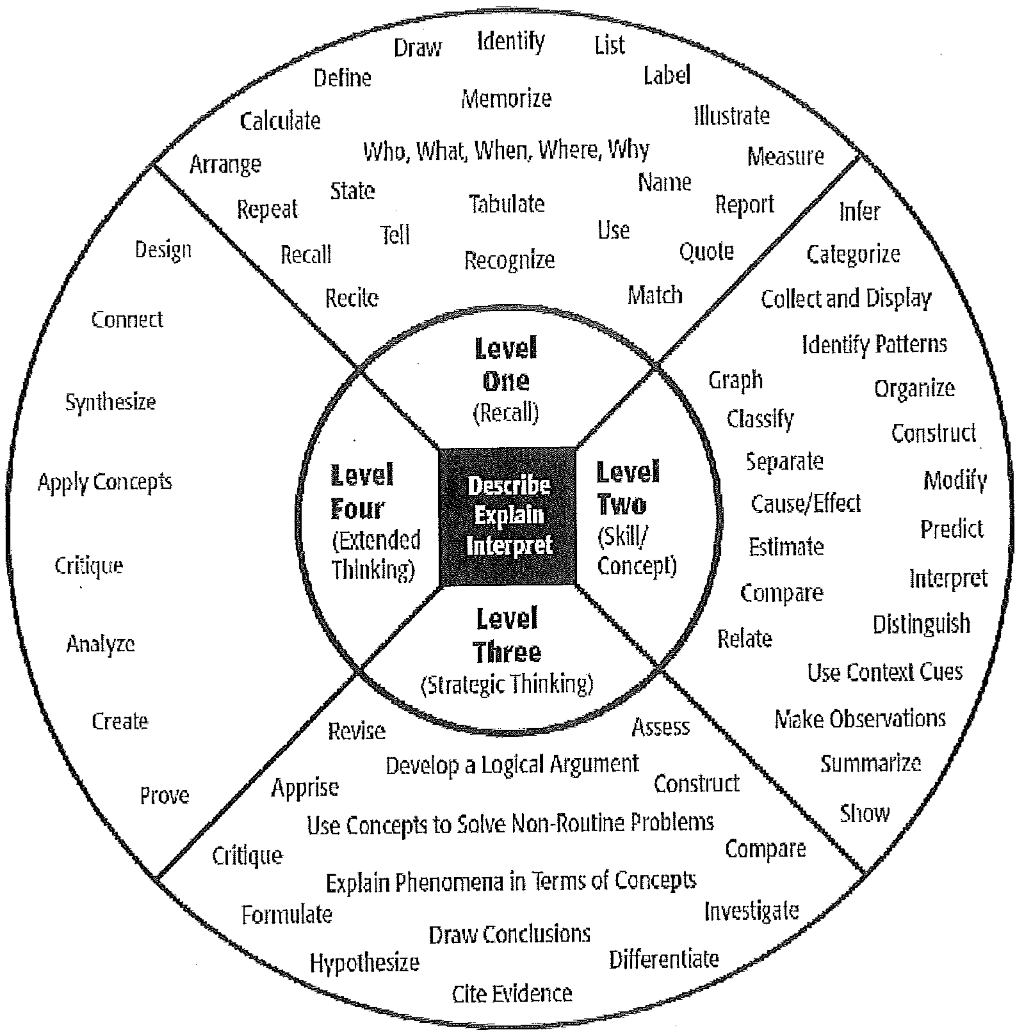
Higher-level demands (doing mathematics):

- Require complex and nonalgorithmic thinking—a predictable, well-rehearsed approach or pathway is not explicitly suggested by the task, task instructions, or a worked-out example.
- Require students to explore and understand the nature of mathematical concepts, processes, or relationships
- Demand self-monitoring or self-regulation of one's own cognitive processes
- Require students to access relevant knowledge and experiences and make appropriate use of them in working through the task
- Require students to analyze the task and actively examine task constraints that may limit possible solution strategies and solutions
- Require considerable cognitive effort and may involve some level of anxiety for the student because of the unpredictable nature of the solution process required

These characteristics are derived from the work of Doyle on academic tasks (1988) and Resnick on high-level-thinking skills (1987), the *Professional Standards for Teaching Mathematics* (NCTM 1991), and the examination and categorization of hundreds of tasks used in QUASAR classrooms (Stein, Grover, and Henningsen 1996; Stein, Lane, and Silver 1996).

Effective Teaching and Learning. (2014). In *Principles to Actions : Ensuring mathematical success for all* (pg. 18). Reston, VA: NCTM.

Depth of Knowledge (DOK) Levels



Level One Activities	Level Two Activities	Level Three Activities	Level Four Activities
Recall elements and details of story structure, such as sequence of events, character, plot and setting. Conduct basic mathematical calculations. Label locations on a map. Represent in words or diagrams a scientific concept or relationship. Perform routine procedures like measuring length or using punctuation marks correctly. Describe the features of a place or people.	Identify and summarize the major events in a narrative. Use context cues to identify the meaning of unfamiliar words. Solve routine multiple-step problems. Describe the cause/effect of a particular event. Identify patterns in events or behavior. Formulate a routine problem given data and conditions. Organize, represent and interpret data.	Support ideas with details and examples. Use voice appropriate to the purpose and audience. Identify research questions and design investigations for a scientific problem. Develop a scientific model for a complex situation. Determine the author's purpose and describe how it affects the interpretation of a reading selection. Apply a concept in other contexts.	Conduct a project that requires specifying a problem, designing and conducting an experiment, analyzing its data, and reporting results/ solutions. Apply mathematical model to illuminate a problem or situation. Analyze and synthesize information from multiple sources. Describe and illustrate how common themes are found across texts from different cultures. Design a mathematical model to inform and solve a practical or abstract situation.

Webb, Norman L. and others. "Web Alignment Tool" 24 July 2005. Wisconsin Center of Educational Research. University of Wisconsin-Madison. 2 Feb. 2006. <http://www.wcer.wisc.edu/WAT/index.aspx>

Engaging in the Process Standards – "Look-fors"

Process Standards		Students:	Teachers:
Overarching habits of mind of a productive math thinker	**1. Make sense of problems and persevere in solving them**	☐ Understand the meaning of the problem and look for entry points to its solution ☐ Analyze information (givens, constrains, relationships, goals) ☐ Make conjectures and plan a solution pathway ☐ Monitor and evaluate the progress and change course as necessary ☐ Check answers to problems and ask, "Does this make sense?" Comments:	☐ Involve students in rich problem-based tasks that encourage them to persevere in order to reach a solution ☐ Provide opportunities for students to solve problems that have multiple solutions ☐ Encourage students to represent their thinking while problem solving Comments:
	6. Attend to precision	☐ Communicate precisely using clear definitions ☐ State the meaning of symbols, carefully specifying units of measure, and providing accurate labels ☐ Calculate accurately and efficiently, expressing numerical answers with a degree of precision ☐ Provide carefully formulated explanations ☐ Label accurately when measuring and graphing Comments:	☐ Emphasize the importance of precise communication by encouraging students to focus on clarity of the definitions, notation, and vocabulary used to convey their reasoning ☐ Encourage accuracy and efficiency in computation and problem-based solutions, expressing numerical answers, data, and/or measurements with a degree of precision appropriate for the context of the problem Comments:
Reasoning and Explaining	**2. Reason abstractly and quantitatively**	☐ Make sense of quantities and relationships in problem situations ☐ Represent abstract situations symbolically and understand the meaning of quantities ☐ Create a coherent representation of the problem at hand ☐ Consider the units involved ☐ Flexibly use properties of operations Comments:	☐ Facilitate opportunities for students to discuss or use representations to make sense of quantities and their relationships ☐ Encourage the flexible use of properties of operations, objects, and solution strategies when solving problems ☐ Provide opportunities for students to decontextualize (abstract a situation) and/or contextualize (identify referents for symbols involved) the mathematics they are learning Comments:
	3. Construct viable arguments and critique the reasoning of others	☐ Use definitions and previously established causes/effects (results) in constructing arguments ☐ Make conjectures and use counterexamples to build a logical progression of statements to explore and support ideas ☐ Communicate and defend mathematical reasoning using objects, drawings, diagrams, and/or actions ☐ Listen to or read the arguments of others ☐ Decide if the arguments of others make sense and ask probing questions to clarify or improve the arguments Comments:	☐ Provide and orchestrate opportunities for students to listen to the solution strategies of others, discuss alternative solutions, and defend their ideas ☐ Ask higher-order questions which encourage students to defend their ideas ☐ Provide prompts that encourage students to think critically about the mathematics they are learning Comments:

Process Standards		Students:	Teacher(s):
Modeling and Using Tools	4. **Model with mathematics**	☐ Apply prior knowledge to solve real world problems ☐ Identify important quantities and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts, and/or formulas ☐ Use assumptions and approximations to make a problem simpler ☐ Check to see if an answer makes sense within the context of a situation and change a model when necessary Comments:	☐ Use mathematical models appropriate for the focus of the lesson ☐ Encourage student use of developmentally and content-appropriate mathematical models (e.g., variables, equations, coordinate grids) ☐ Remind students that a mathematical model used to represent a problem's solution is 'a work in progress,' and may be revised as needed Comments:
	5. **Use appropriate tools strategically**	☐ Make sound decisions about the use of specific tools (Examples might include: calculator, concrete models, digital technologies, pencil/paper, ruler, compass, protractor) ☐ Use technological tools to visualize the results of assumptions, explore consequences, and compare predications with data ☐ Identify relevant external math resources (digital content on a website) and use them to pose or solve problems ☐ Use technological tools to explore and deepen understanding of concepts Comments:	☐ Use appropriate physical and/or digital tools to represent, explore and deepen student understanding ☐ Help students make sound decisions concerning the use of specific tools appropriate for the grade level and content focus of the lesson ☐ Provide access to materials, models, tools and/or technology-based resources that assist students in making conjectures necessary for solving problems Comments:
Seeing structure and generalizing	7. **Look for and make use of structure**	☐ Look for patterns or structure, recognizing that quantities can be represented in different ways ☐ Recognize the significance in concepts and models and use the patterns or structure for solving related problems ☐ View complicated quantities both as single objects or compositions of several objects and use operations to make sense of problems Comments:	☐ Engage students in discussions emphasizing relationships between particular topics within a content domain or across content domains ☐ Recognize that they quantitative relationships modeled by operations and their properties remain important regardless of the operational focus of a lesson ☐ Provide activities in which students demonstrate their flexibility in representing mathematics in a number of ways e.g., $76 = (7 \times 10) + 6$; discussing types of quadrilaterals, etc. Comments:
	8. **Look for and express regularity in repeated reasoning**	☐ Notice repeated calculations and look for general methods and shortcuts ☐ Continually evaluate the reasonableness of intermediate results (comparing estimates), while attending to details, and make generalizations based on findings Comments:	☐ Engage students in discussion related to repeated reasoning that may occur in a problem's solution ☐ Draw attention to the prerequisite steps necessary to consider when solving a problem ☐ Urge students to continually evaluate the reasonableness of their results Comments:

PROCESS STANDARDS FOR MATHEMATICS

The Process Standards demonstrate the ways in which students should develop conceptual understanding of mathematical content, and the ways in which students should synthesize and apply mathematical skills.

PROCESS STANDARDS FOR MATHEMATICS	
PS.1: Make sense of problems and persevere in solving them.	Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway, rather than simply jumping into a solution attempt. They consider analogous problems and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" and "Is my answer reasonable?" They understand the approaches of others to solving complex problems and identify correspondences between different approaches. Mathematically proficient students understand how mathematical ideas interconnect and build on one another to produce a coherent whole.
PS.2: Reason abstractly and quantitatively.	Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.
PS.3: Construct viable arguments and critique the reasoning of others.	Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They analyze situations by breaking them into cases and recognize and use counterexamples. They organize their mathematical thinking, justify their conclusions and communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. They justify whether a given statement is true always, sometimes, or never. Mathematically proficient students participate and collaborate in a mathematics community. They listen to or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

PS.4: Model with mathematics.	Mathematically proficient students apply the mathematics they know to solve problems arising in everyday life, society, and the workplace using a variety of appropriate strategies. They create and use a variety of representations to solve problems and to organize and communicate mathematical ideas. Mathematically proficient students apply what they know and are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.
PS.5: Use appropriate tools strategically.	Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Mathematically proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. Mathematically proficient students identify relevant external mathematical resources, such as digital content, and use them to pose or solve problems. They use technological tools to explore and deepen their understanding of concepts and to support the development of learning mathematics. They use technology to contribute to concept development, simulation, representation, reasoning, communication and problem solving.
PS.6: Attend to precision.	Mathematically proficient students communicate precisely to others. They use clear definitions, including correct mathematical language, in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They express solutions clearly and logically by using the appropriate mathematical terms and notation. They specify units of measure and label axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently and check the validity of their results in the context of the problem. They express numerical answers with a degree of precision appropriate for the problem context.
PS.7: Look for and make use of structure.	Mathematically proficient students look closely to discern a pattern or structure. They step back for an overview and shift perspective. They recognize and use properties of operations and equality. They organize and classify geometric shapes based on their attributes. They see expressions, equations, and geometric figures as single objects or as being composed of several objects.
PS.8: Look for and express regularity in repeated reasoning.	Mathematically proficient students notice if calculations are repeated and look for general methods and shortcuts. They notice regularity in mathematical problems and their work to create a rule or formula. Mathematically proficient students maintain oversight of the process, while attending to the details as they solve a problem. They continually evaluate the reasonableness of their intermediate results.